U.S. Department of Transportation
United States Coast Guard

United States Coast Guard
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COMDTNOTE 16500
SEP 17 1997

COMMANDANT NOTICE 16500

CANCELLED: SEP 16 1998

Subj: CHANGE 2 TO COMDTINST M16500.8A, AUTOMATION TECHNICAL GUIDELINES

1. PURPOSE. This Notice promulgates changes to the Automation Technical Guidelines.

2. ACTION. Area and district commanders, commanders of maintenance and logistics commands, and commanding officers of headquarters units shall ensure that the required page replacements are made for this change.

3. PROCEDURES.

   a. The change provides implementations of standard range equipment on range categories and their criteria presented in Chapter 1. It consists of 28 replacement pages. Remove and insert the following pages:

Remove	Insert
i thru v	i thru v
2-23 thru 2-30	2-23 thru 2-39
3-21 thru 3-22	3-21 thru 3-22
7-19 thru 7-20	7-19 thru 7-21

   b. Units that have not received COMDTINST M16500.8A, but have received this Change may requisition a copy of COMDTINST M16500.8A and Change 1 from DOT Warehouse in accordance with COMDTNOTE 5600; Directives, Publications and Report Index.

E.C. KARNIS
Director of Engineering

DISTRIBUTION – SDL No.135

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
A							1*						1*													
B		8	20		1									6	3				2			2			3	
C				1		2	3		1*		1												1			
D				1																						1
E							1															1				
F																										
G																										
H																										

NON-STANDARD DISTRIBUTION: *B:c MLCLANT and MLCPAC (6 extra), *C:i STA St Ignace & STA Channel Is Hbr only, *A:g Ninth Dist I/B Tugs only, *A:m* Ninth Dist Buoy Tenders only

AUTOMATION TECHNICAL GUIDELINES

CONTENTS

CONTENTS (Continued)

FIGURES

TABLES

D. Ranges - General. Selection of the appropriate category for a range should be made in accordance with the guidelines outlined in Chapter 1 of this manual. Ranges may have both daytime and nighttime optics, or nighttime optics alone, which may or may not be daylight controlled. While the following discussion of standard ranges implies that similar systems are used on both front and rear towers, in fact, the power systems and optics may be different. For instance, a large day/night range may have 120VAC optics for the daytime signal and 12VDC optics for the nighttime signal on the rear tower, with 12VDC optics for both daytime and nighttime signals on the front tower. In this example, the front tower lights may be powered from 120VAC, via an AC/DC converter, or by solar power. The selection of appropriate signal and power equipment should be based on the light intensity required and the availability of reliable commercial power.

E. Standard 120VAC Ranges. Commandant (G-SEC) centrally procures and stocks 24 inch (RL24) directional range lanterns for use in waterways projects. The 14 inch (RL14) directional range lanterns are stocked in the Supply Fund (Commodity 5). Omnidirectional 250mm and 300mm lanterns, with and without condensing panels, are also used on 120VAC powered ranges. Other signaling systems, such as extended light sources, directional lights, or alternative lighting technologies, are not discussed in this manual. Information regarding these systems may be obtained from Commandant (G-SEC).

This section specifically discusses the optics and control equipment used with AC power. The range may have day and night optics, or night optics only, and may use 12VDC power for one or more signals. Selection of the appropriate range category should be made in accordance with the guidelines established in Chapter 1.

1. Standard 120VAC Directional Range Lanterns.

   a. 24 Inch Range Lanterns. The RL24 uses the same optic as the DCB24/224 Rotating Beacons, and comes equipped with the CG-2P lamp changer. The RL24 should be outfitted with 1000 watt, mogul-bipost lamps. These range lanterns can be equipped with filters of any approved signal color.

   b. 14 Inch Range Lantern. The RL14 optic uses a 14 inch, deep-dish parabolic mirror to generate a highly collimated pencil beam. The RL14 may be equipped for either 120VAC or 12VDC operation. In AC-applications the RL14 is equipped with a four-place lamp changer (CG-4P), outfitted with either 150 watt or 250 watt DC-bayonet mount lamps. The CG-4P is commercially available. A more extensive discussion of the RL14

may be found in Section F, below.

2. Other Directional Range Lanterns. The 250mm and 300mm omnidirectional lanterns may be considered quasi-directional with the addition of condensing panels.

3. Standard 120VAC Omnidirectional Range Lanterns. The primary omnidirectional lanterns for new installations are the 250mm and 300mm marine signal lanterns. As with lighthouse applications, selection of the appropriate lantern must include an evaluation of required power dissipation. The unvented version of the 250mm can only dissipate the equivalent of 75 watts, continuous, while a vented version can dissipate up to 200 watts. The 300mm can dissipate 250 watts continuously. For AC-applications, only the 250W lamp should be used in these lanterns.

   Non-rotating classical lenses should be retained if serviceable. Any modification or replacement of a classical lens must be coordinated with the appropriate historic preservation interests.

4. Emergency Range Lanterns. When required, emergency range lanterns should normally be provided by 12VDC powered range lanterns, equipped with CG-181 flashers and CG-6P lamp changers, and outfitted with 12VDC lamps. The emergency lantern should have the same characteristic as the primary range lantern. Range Category C-RLC and S-RLC systems may employ the nighttime range lanterns as the emergency lights for the daytime optics. In this case, a third set of range lanterns may be used to backup the nighttime optics. UNDER NO CIRCUMSTANCES SHOULD DAYTIME OPTICS BE USED TO BACKUP NIGHTTIME OPTICS.

5. Sound Signals. Sound signals are not normally used on range towers. If required, however, the standard sound signals prescribed for lighthouses may be used.

6. 120VAC Range Control Systems. There are four basic control systems for 120VAC ranges as discussed in Chapter 1, and an optional 12VDC emergency range system suitable for use with each of them. Two systems have both daytime and nighttime optics; the other two are simplified systems, one operating 24 hours a day and the other a daylight controlled nighttime-only signal.

   a. Commercial Powered Range Category C-RLC Control System. This category employs the Range Light Controller (RLC), GCF-W-1201-RLC, to control the range lanterns. A complete system is made up of two RLCs, one on each range tower. A single RLC consists

of two fiberglass NEMA enclosures; one for the Control Unit, and one for the Power Unit. Each RLC can support up to four daytime optics, two primary nighttime optics, and one optional emergency nighttime optic. The RLC uses a Type L daylight control.

The RLCs communicate via a radio/modem to synchronize front and rear day/night mode switching. The RLCs also permit synchronization of front and rear flash rhythms. RLCs will support fixed or flashing characteristics at one or both towers.

The RLC can operate as an ACMS Remote Unit, and can communicate with the ACMS Master Unit via radio link, direct telephone, or cellular telephone. One of the two RLCs in a Range Category C-RLC aid is designated the master, and exchanges status and control information with the ACMS Master Unit, if monitored.

The wiring diagram for a RLC, 120VAC daytime and primary nighttime optics, and 12VDC secondary (emergency) nighttime optics, is depicted in Figure 2-7. Many of the system components are omitted to simplify the diagram. Detailed interconnection drawings are included in the list of standard drawings found in Chapter 7. Detailed circuit and logic explanations are included in the RLC manual which is shipped with the unit. (Figure 2-7)

b. Commercial Powered Range Category C-D/N Control System. The control system at a Range Category C-D/N aid employs a light-sensitive Range Switch Box - AC (RSB-AC) to switch between day and night signals, an AC Flash Controller for flashing (if needed) a 1000W daytime signal, and a FLAC-300 (if needed) to flash the nighttime signal. Daylight control switching at the front and rear towers are not synchronized, nor can the flash rhythms be synchronized.

(1) Range Switch Box -AC. The Range Switch Box - AC (RSB-AC) uses a simple switching technique to toggle between daytime and nighttime operation depending on ambient light conditions. When the ambient light level falls below a preset threshold, the type K-4221 photoelectric sensor/switch activates a power relay which turns on the nighttime light and turns off the daytime light.

(2) AC Flash Controller. The AC Flash Controller is described in the discussion on 120VAC Light Control Systems, on page 2-7. It is only used for flashing the 1000 watt lamp used in the RL24

and some classical lenses.

(3) FLAC-300. The FLAC-300 is described in the discussion on 120VAC Light Control Systems, on page 2-8. It will normally be used in range lanterns outfitted with either the 150 watt or 250 watt lamps, such as the RL14, the 250mm lantern, and 300mm lanterns. (Figure 2-8)

c. Commercial Powered Range Category C-24 Control System. The control system at a Range Category C-24 aid employs either an AC Flash Controller for flashing (if needed) a 1000W signal or a FLAC-300 to flash (if needed) a 150W or 250W signal. The same lantern is used for both daytime and nighttime signals, thus synchronization of the front and rear day/night mode switching is not required. The flash rhythms can not be synchronized. (Figure 2-9)

d. Commercial Powered Range Category C-N Control System. The control system at a Range Category C-N aid employs a Type L Daylight Control to turn the light on at night, and a FLAC-300 to flash (if needed) the nighttime signal. There is no daytime light signal. Synchronization of the front and rear day (off)/night (on) mode switching is not available, nor is synchronization of the flash rhythms. (Figure 2-10)

e. Optional Emergency Range Control System for 120VAC Main Light. This system employs an Emergency Switch Box - AC (ESB-AC) to turn on an optional emergency range light when main signal voltage falls below a preset threshold. The ESB-AC has a normally-closed relay which is held open when the main range light is operating normally, and deenergizes when the main signal voltage falls below 36VAC, turning on the emergency range light. (Figure 2-15)

F. Standard 12VDC Solar Ranges. The Engineering Logistics Center stocks 14 inch (RL14) directional range lanterns in the Supply Fund (Commodity 5). Omnidirectional 250mm and 300mm lanterns, with and without condensing panels, are also used on 12VDC powered ranges and are commercially purchased. Other signaling systems, such as extended light sources, directional lights, or alternative lighting technologies, are not discussed in this manual. Information regarding these systems may be obtained from Commandant (G-SEC).

This section specifically discusses the optics and control equipment used with DC power. The range may have day and night optics, or night optics only. Selection of the appropriate range category should be made in accordance with the guidelines established in Chapter 1.

1. Standard 12VDC Directional Range Lanterns. The standard 12VDC directional range lantern is the 14 inch range lantern (RL14). There are two versions of RL14 range lanterns in service; the RL-10668 and the RL-355. These are the manufacturers' designations, which will only be cited for positive identification of an optic. Only the RL-10668, or other RL14s built to the same design, are approved for new installations.

   The RL14 optic uses a 14 inch, deep-dish parabolic mirror to generate a highly collimated pencil beam. The primary differences between the two versions of this optic are that the RL-10668 uses a metal mirror and has several machined surfaces to insure metal-to-metal contact at all key interfaces, while the RL-355 uses a glass mirror and does not have metal-to-metal contact at the junction between the bezel assembly (door) and the drum. Serviceable RL-355 range lanterns may be retained in service, but should be replaced if the mirror is broken or the optic is otherwise damaged.

   For DC applications, the RL14 is equipped with the CG-6P lamp changer, and can be outfitted with a wide variety of 12VDC lamps. These include all the standard marine signal lamps, a series of CC-8 filament lamps, and a series of tungsten-halogen lamps, up to and including the 12VDC 110 watt lamp. The CG-6PHW, high-wattage version of the six-place lamp changer, should be used with any 12VDC lamp rated at 50 watts or more.

   The RL14 can be equipped with filters of any approved signal color, and with a series of spread lenses. A spread lens must be used with the standard 12VDC marine signal lamps (ie: the 0.25A to 3.05A lamps), due to the potential for beam wander. The CC-8 filament lamps and tungsten-halogen lamps may be used with or without spread lenses.

2. Other Directional Range Lanterns. The FA-240 range lantern remains in widespread use. While this optic does not produce the same intensity as the RL14, and requires that lamps be hand-selected for proper focus, serviceable FA-240 range lanterns should remain in service. New installations and replacement of damaged optics, however, should use the RL14 or omnidirectional optics. The 250mm and 300mm omnidirectional lanterns may be considered quasi-directional with the addition of condensing panels.

3. Standard 12VDC Omnidirectional Range Lanterns. The primary omnidirectional range lanterns for new installations are the 250mm and 300mm marine signal lanterns. The unvented version of the 250mm lantern can only dissipate 75 watts continuously. Therefore, 100

watt and 110 watt tungsten-halogen lamps cannot be burned fixed-on in this optic.

In some limited cases, the 155mm buoy lantern may make an acceptable range lantern. The 155mm lantern cannot accept lamps with bulbs larger than the S-8 bulbs found on the 12VDC, 0.25A to 2.03A, marine signal lamps.

The CC-8 filament, and tungsten-halogen lamps smaller than 100 watts are not approved for use in omnidirectional range lanterns, as the relatively short filaments will result in a reduced vertical divergence of the light output.

Classical lenses should not be used with 12VDC lamps, due to poor coupling between the light source and the lens.

4. Emergency Range Lanterns. When required, emergency lights shall normally be provided by RL14 range lanterns, due to the ability of this lantern to provide the greatest light output for the smallest lamp size. The emergency lantern should have the same characteristic as the primary range lantern. Solar Range Category S-RLC systems may employ the primary nighttime range lanterns as the emergency lights for the daytime optics, with a secondary nighttime optic as backup for the nighttime signal. UNDER NO CIRCUMSTANCES SHOULD DAYTIME OPTICS BE USED TO BACKUP NIGHTTIME OPTICS.

5. Sound Signals. Sound signals are not normally used on range towers. If required, however, the standard sound signals prescribed for lighthouses may be used.

6. Solar Range Control Systems. There are four basic control systems for 12VDC ranges as discussed in Chapter 1, and an optional 12VDC emergency range system suitable for use with each of them. Two systems have both daytime and nighttime optics, and the other two are simplified systems, one operating 24 hours a day and the other a daylight controlled, nighttime-only signal.

   a. Solar Range Category S-RLC Control System. This category employs the Range Light Controller (RLC), GCF-W-1201-RLC, to control the range lanterns. A complete system is made up of two RLCs, one on each range tower. A single RLC consists of two fiberglass NEMA enclosures; one for the Control Unit, and one for the Power Unit. Each RLC can support up to three daytime optics, two primary nighttime optics, and one optional emergency nighttime optic. The RLC uses a Type L daylight control.

      The RLCs communicate via a radio/modem to synchronize

front and rear day/night mode switching. The RLCs also permit synchronization of front and rear flash rhythms. RLCs will support fixed or flashing characteristics at one or both towers.

The RLC can operate as an ACMS Remote Unit, and can communicate with the ACMS Master Unit via radio link, direct telephone, or cellular telephone. One of the two RLCs in a Range Category S-RLC aid is designated the master, and exchanges status and control information with the ACMS Master Unit, if monitored.

The wiring diagram for a RLC and 12VDC range lanterns (daytime, primary nighttime and secondary nighttime) is depicted in Figure 2-11. Several system components are omitted for clarity. Detailed interconnection drawings are included in the list of standard drawings found in Chapter 7. Detailed circuit and logic explanations are included in the RLC manual which is shipped with the unit. (Figure 2-11)

b. Solar Range Category S-D/N Control System. The control system at a Solar Range Category S-D/N aid employs a light-sensitive Range Switch Box (RSB-DC) to switch between day and night signals. The RSB-DC uses a simple switching technique to toggle between daytime and nighttime operation depending on ambient lighting conditions. When the ambient light level falls below a preset threshold, the Type-L photoelectric sensor/switch activates a power relay which turns on the nighttime light and turns off the daytime light. A Range Power Box (RPB) is used to tie solar arrays, batteries and RSB-AC together. Daylight control switching of the front and rear towers is not synchronized, nor can the flash rhythms be synchronized. (Figure 2-12)

c. Solar Range Category S-24 Control System. The control system at a Solar Range Category S-24 aid employs a Range Power Box (RPB) to tie solar arrays, batteries and the 24-hour operation light signal together. (Figure 2-13)

d. Solar Range Category S-N Control System. The control system at a Solar Range Category S-N aid employs a Type-L Daylight Control to turn the light on at night. This is a nighttime-only operation, and there is neither switching between daytime and nighttime signals, nor synchronization between the front and rear tower. (Figure 2-14)

e. Optional Emergency Range Control System for 12VDC Main Light. This system employs an Emergency Switch

Box - DC (ESB-DC) to turn on an optional emergency range light when the main signal voltage falls below a preset threshold. The ESB-DC has a normally-closed relay , which is held open when the main range light is operating normally, and deenergizes when the main signal voltage falls below 3.2VDC, turning on the emergency range light. (Figure 2-15)

COMMERCIAL-DAY/NIGHT RANGE-SYNCH TRANSFER (Category C-RLC)

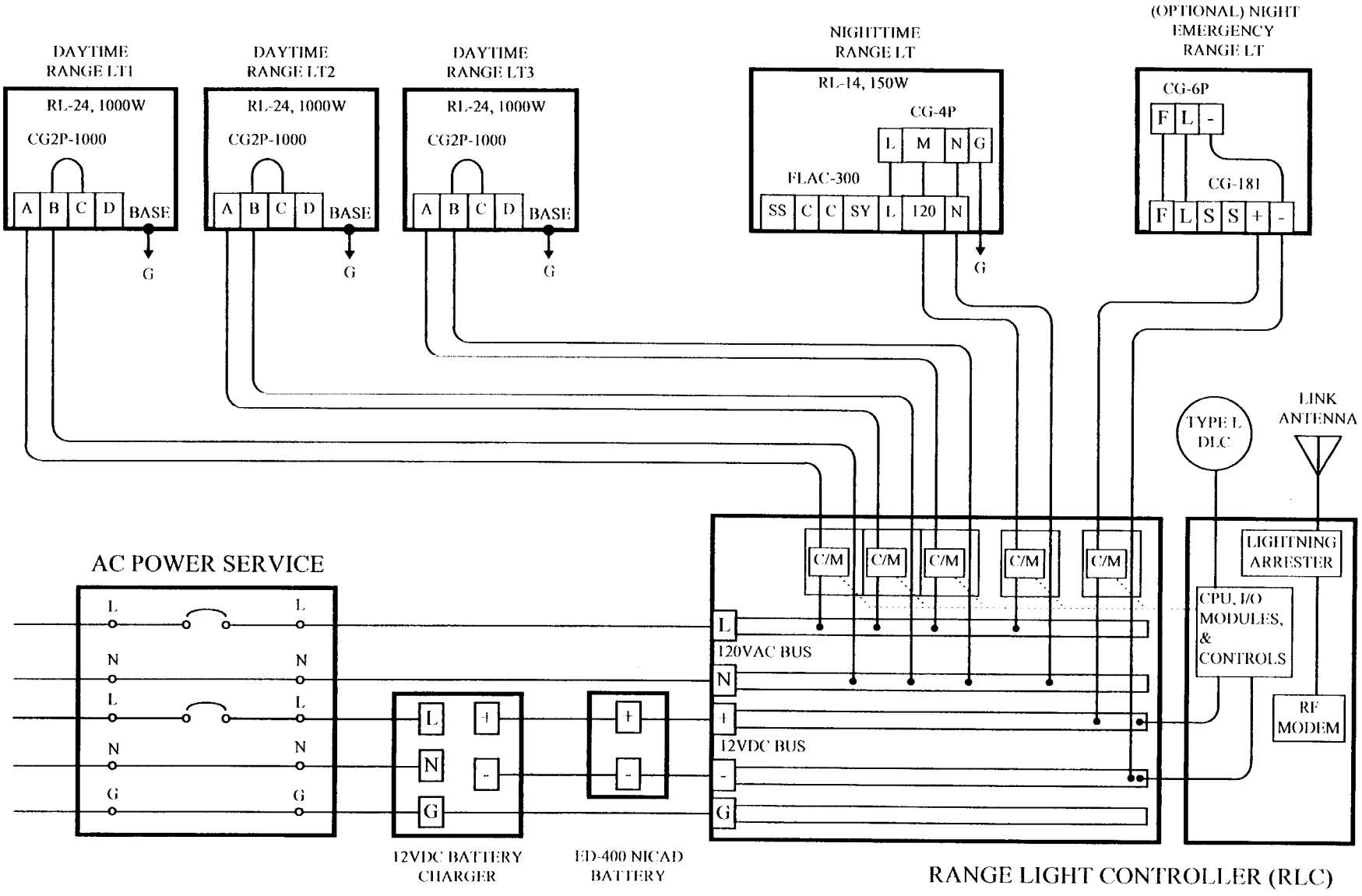

Figure 2-7

COMMERCIAL-DAY/NIGHT RANGE (Category C-D/N)

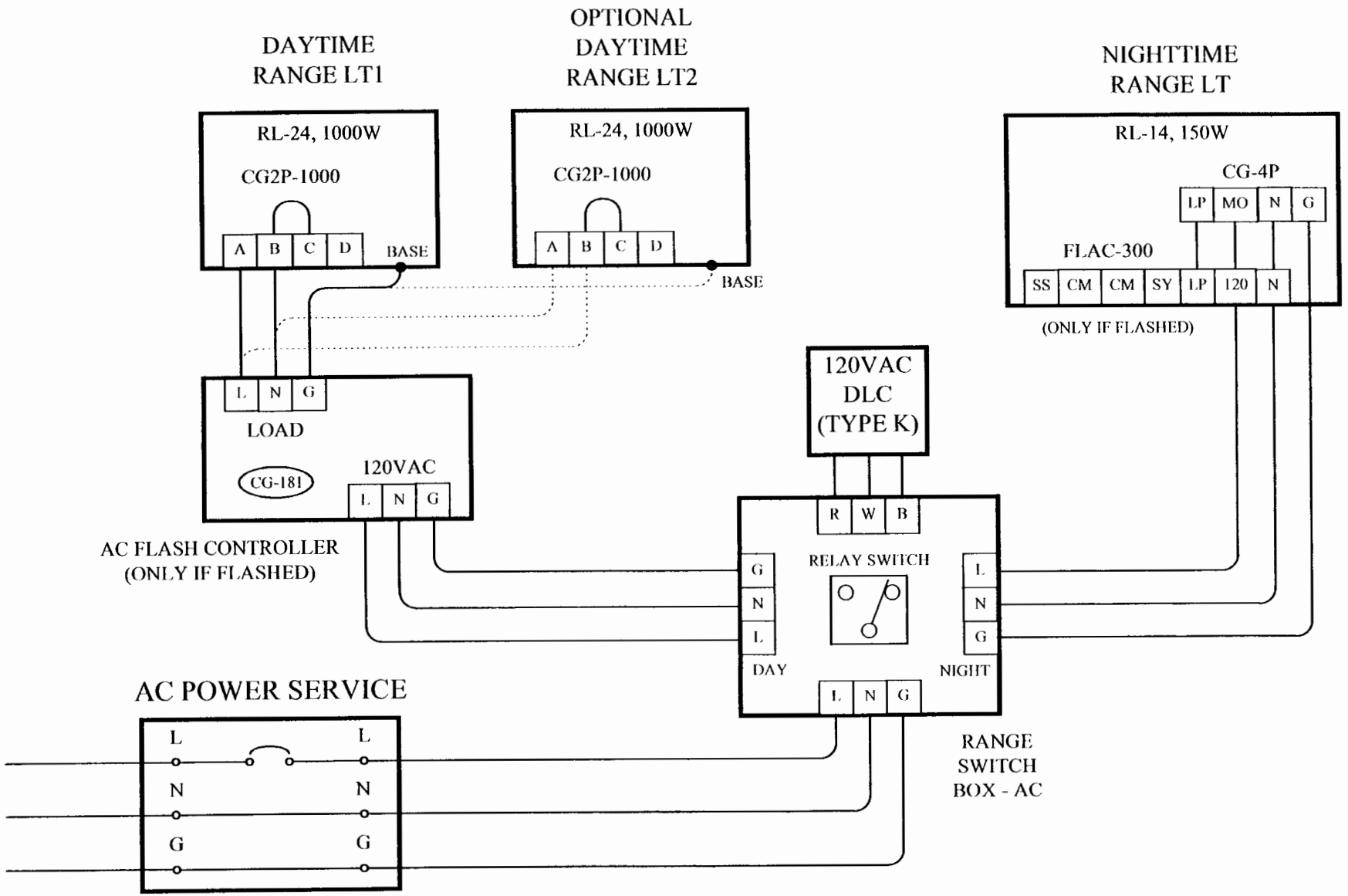

Figure 2-8

COMMERCIAL-24 HOUR RANGE (Category C-24)

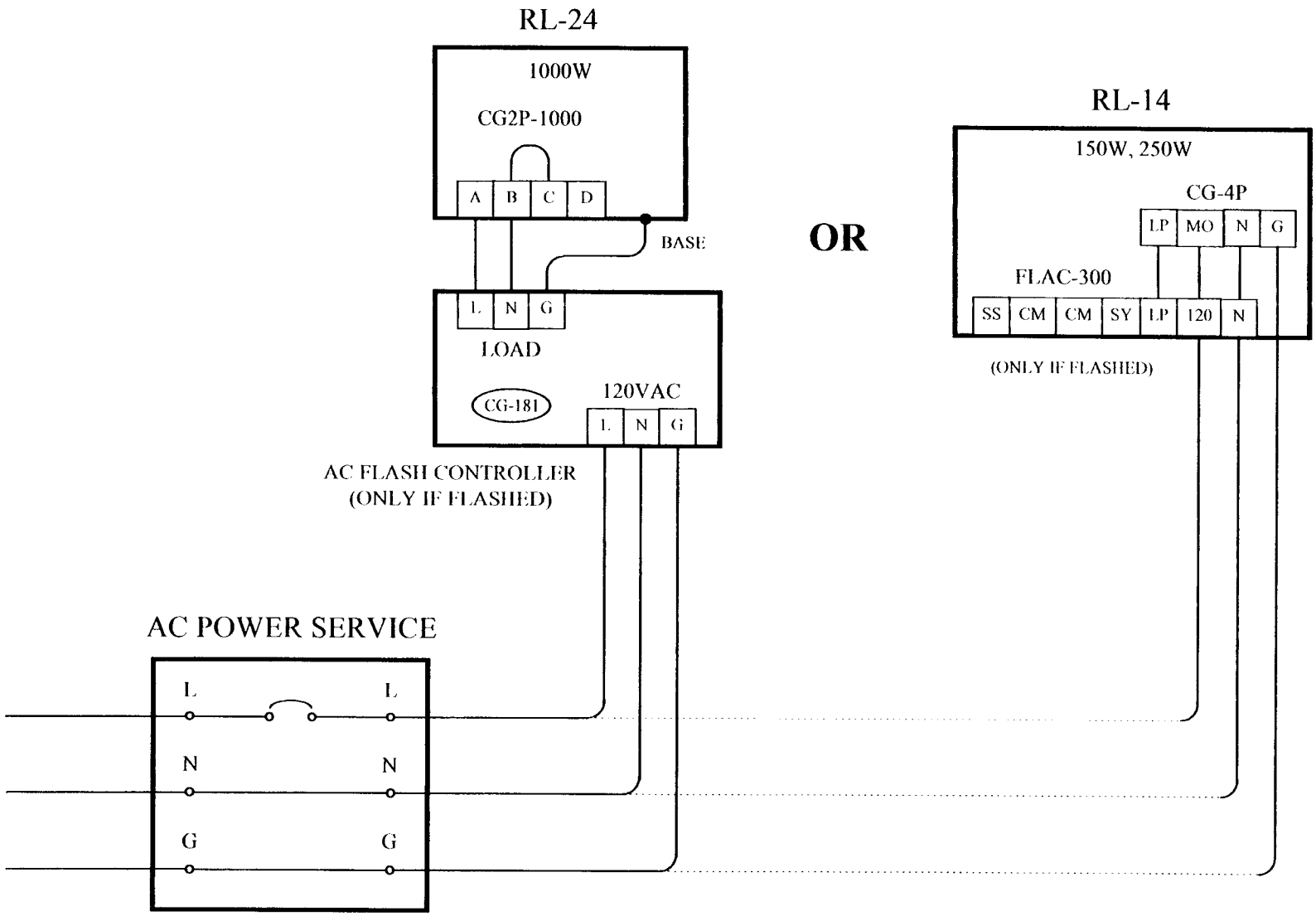

Figure 2-9

COMMERCIAL-NIGHT (ONLY) RANGE (Category C-N)

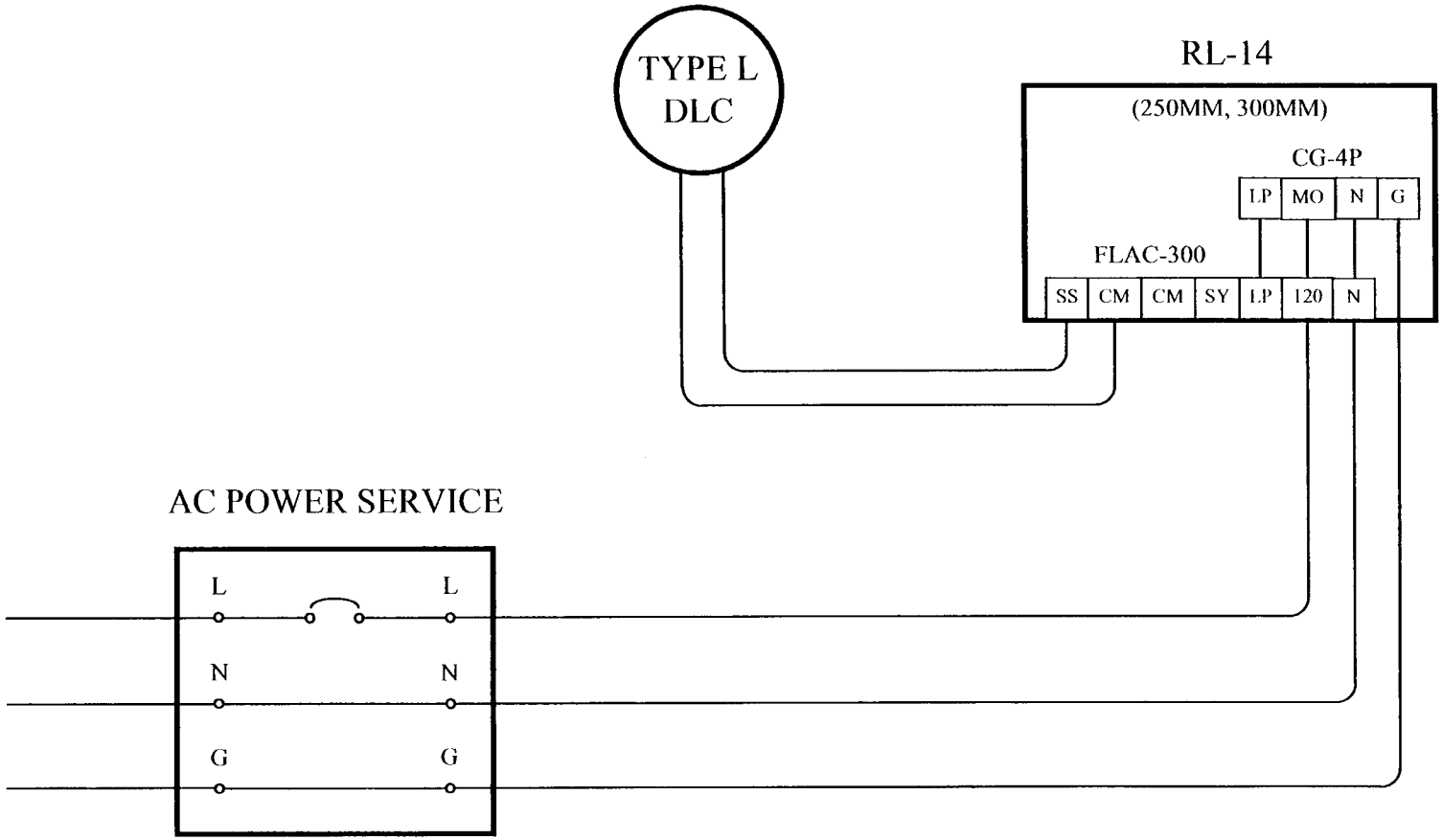

Figure 2-10

SOLAR-DAY/NIGHT RANGE-SYNCH TRANSFER (Category S-RLC)

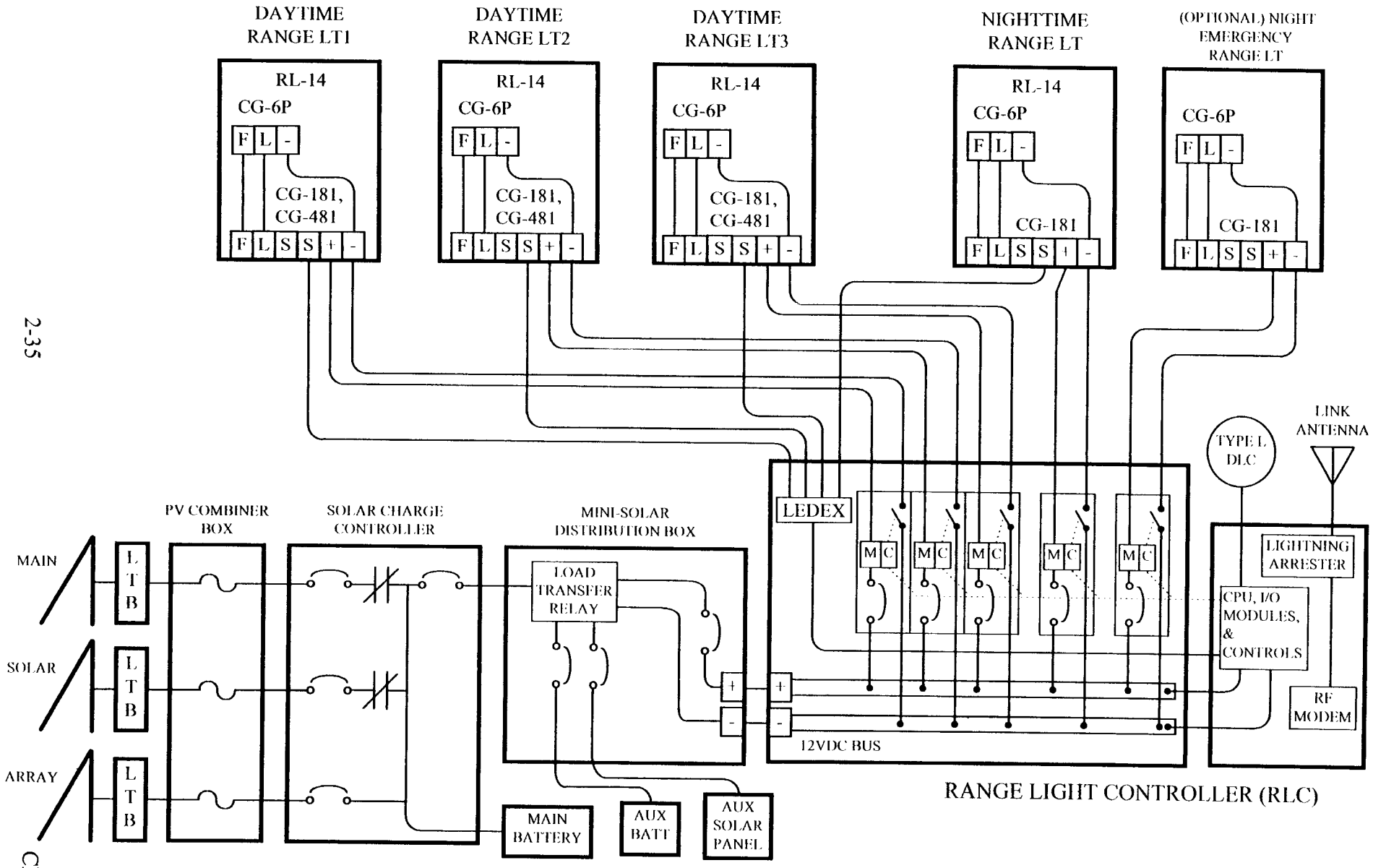

Figure 2-11

SOLAR-DAY/NIGHT RANGE (Category S-D/N)

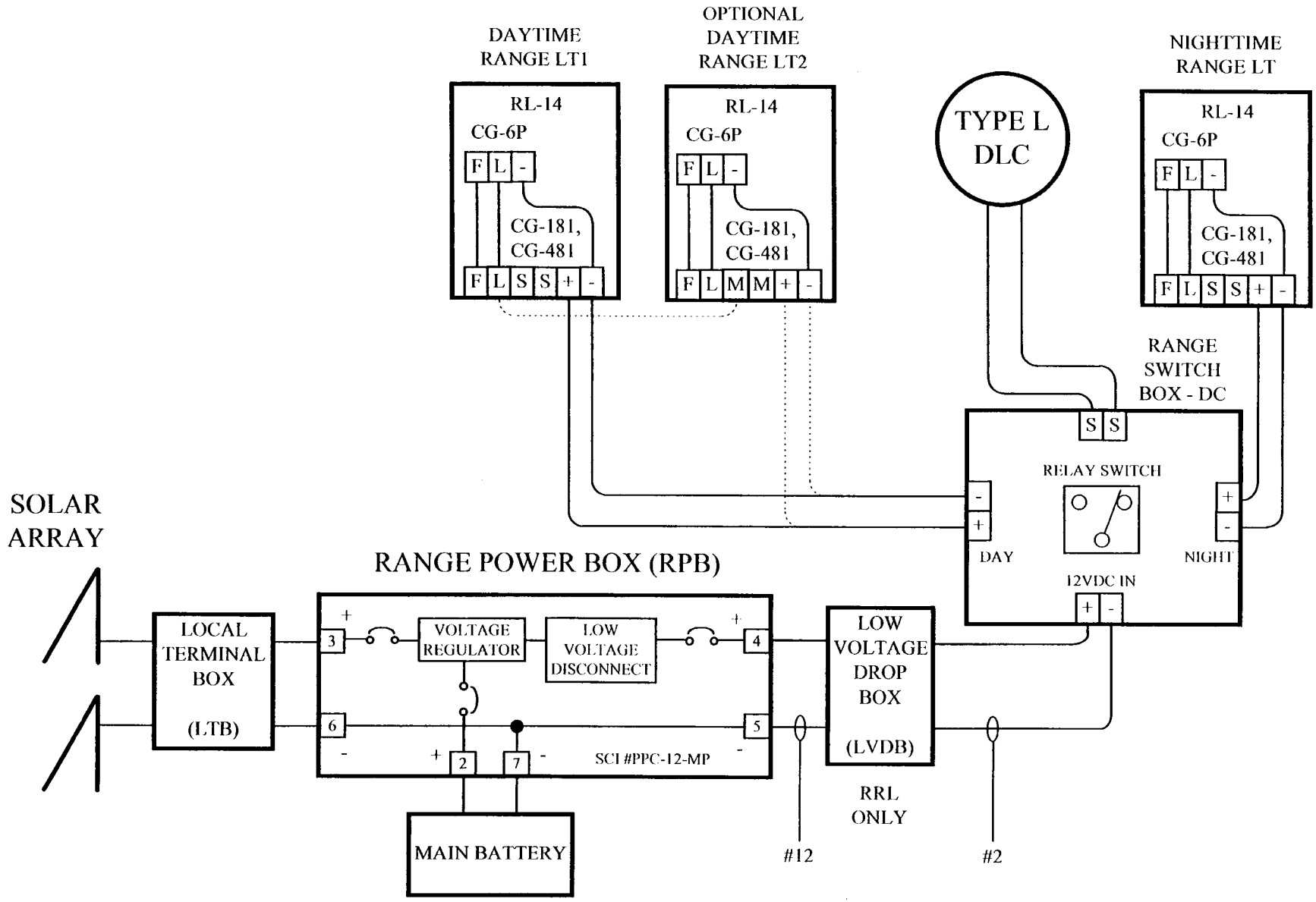

Figure 2-12

SOLAR-24 HOUR RANGE (Category S-24)

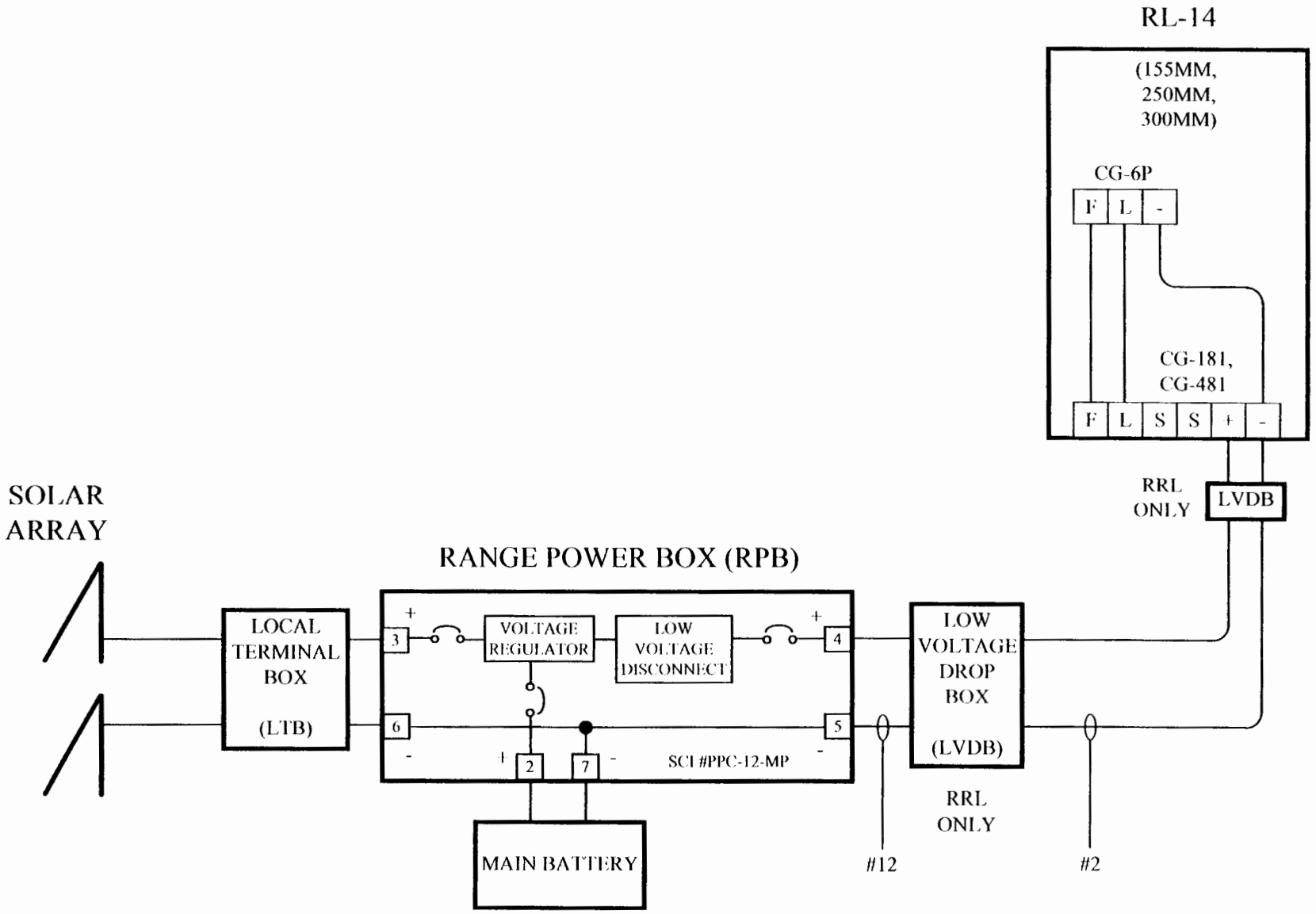

Figure 2-13

SOLAR-NIGHT (ONLY) RANGE (Category S-N)

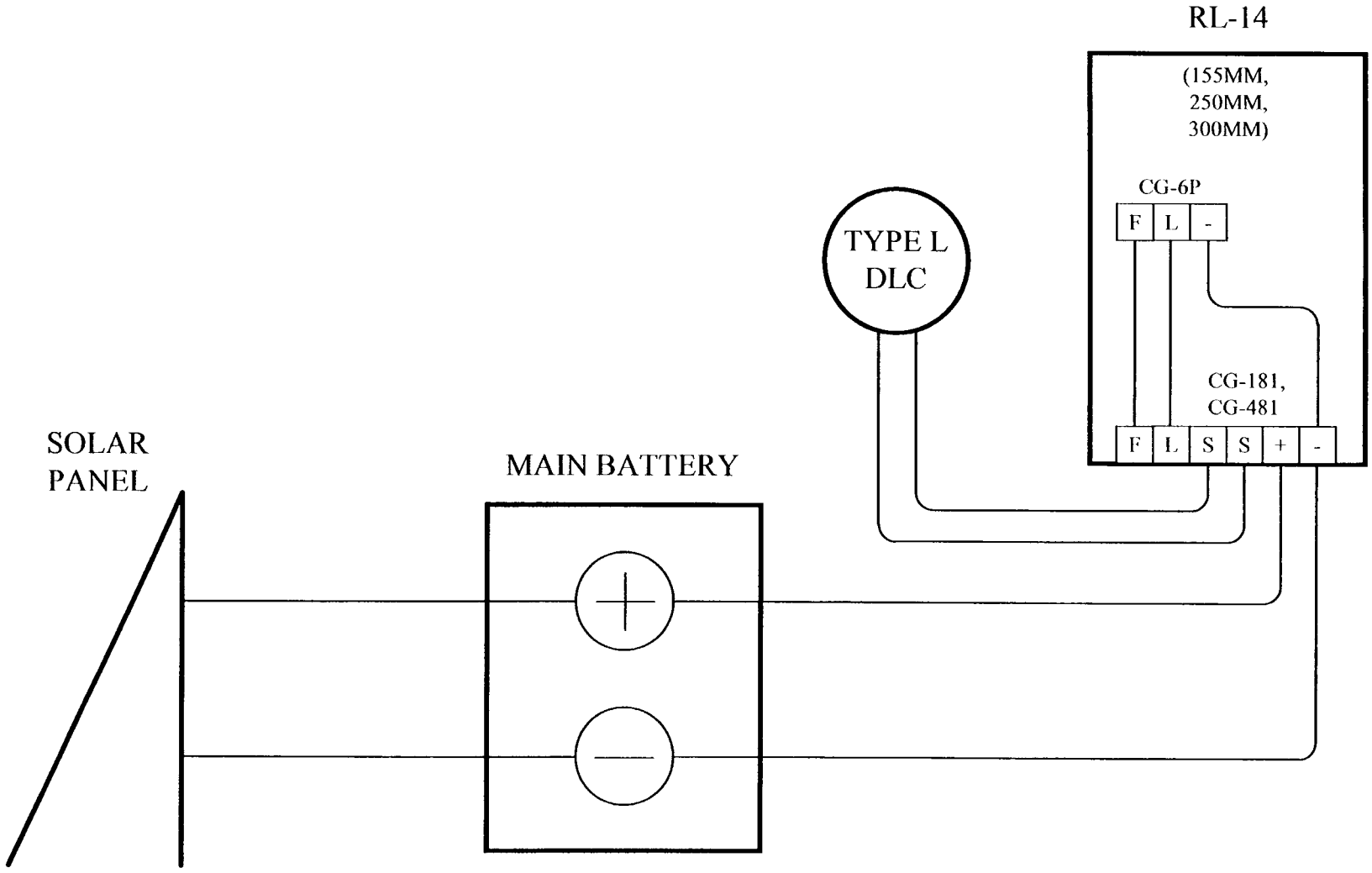

Figure 2-14

OPTIONAL EMERGENCY RANGE

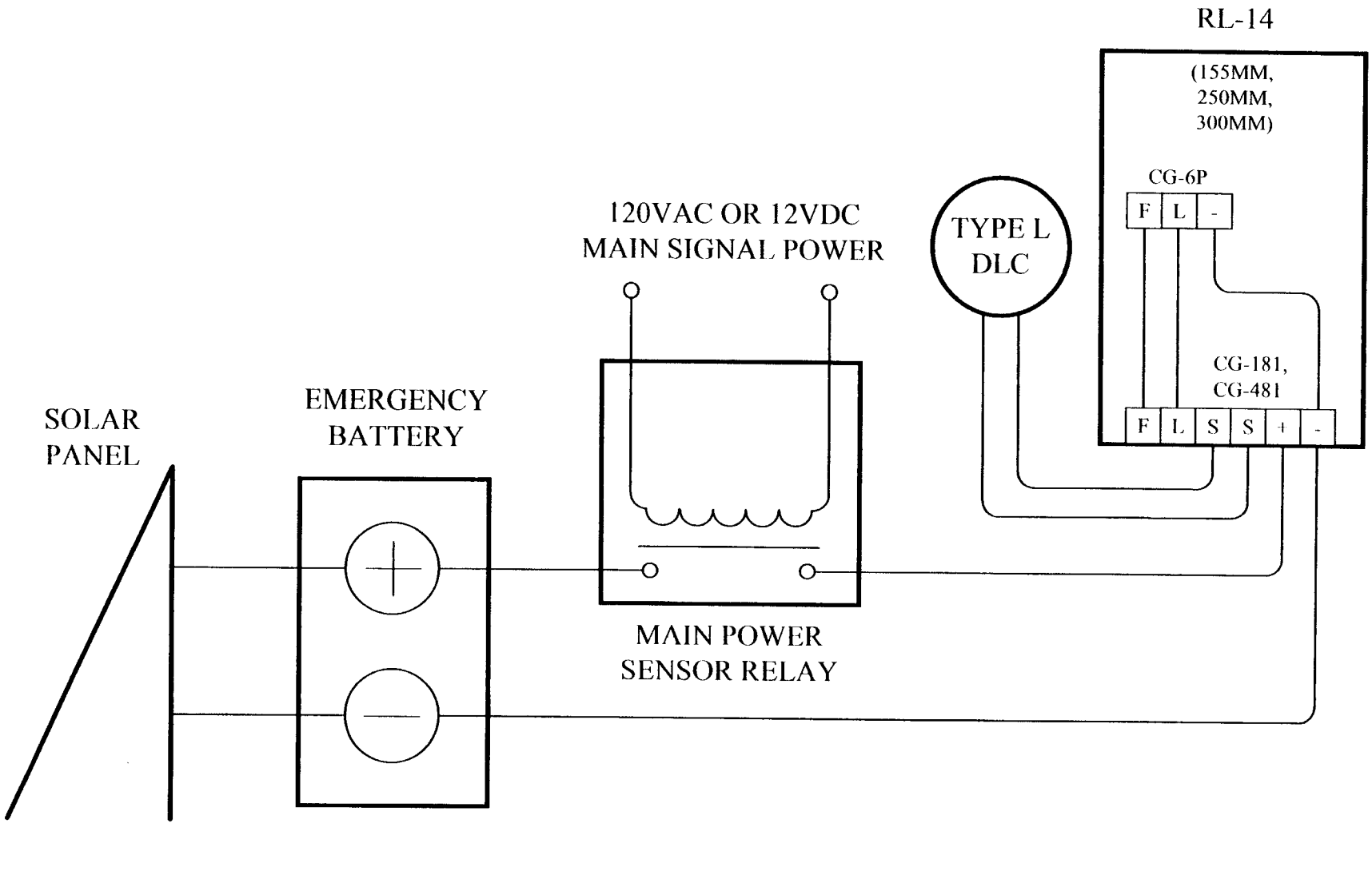

Figure 2-15

the difference of the average monthly temperatures exceeds 20 degrees F, a temperature controller can be installed in the charge controller to interrupt the signal to the mercury relays allowing full charging during cold periods.

6. Main Battery. The preferred battery used for stationary installations above 350 ampere-hours is the Yuasa-Exide EJ and FHGS series cells. These cells are tubular design, have clear cases to facilitate visual checks, and have liquid electrolyte (which is more forgiving than other technologies). These cells are fragile, must be handled very carefully and require installation on stable platforms. Alternatives to these cells are the GNB Absolyte II (absorbed electrolyte) and Sonnenschein A600 Solar (gelled electrolyte). Cells are two volts, requiring six cells connected in series to produce 12 volts. The minimum battery size is calculated by the solar design program and is based on the maximum daily load and the desired autonomy (8-14 days typical).

7. Standby Battery. The standby battery is the same as described in paragraph E.6.d. When used with the SDB, it drives the emergency signals when the main battery is disconnected. When used with the Multiarray Controller (MAC), the standby battery will operate the main signals when the main battery is disconnected. The size of the standby battery should be based on a slightly longer autonomy of 12 days.

8. Battery Charging. A portable 12 volt DC engine-generator has been staged at selected support facilities to provide the initial freshening charge on the battery and to recharge it if a failure occurs. The generator is diesel powered, weighs 120 pounds, is capable of providing 70 amperes continuous, 100 amperes maximum, with adjustable output voltage, and carries enough fuel for 24 hours of operation. Contact Commandant (G-SEC-2) for the location of the portable unit nearest you.

9. Special Considerations. Voltage drop at 12 volt aids is a major consideration, especially with the loads typically found at solar powered lighthouses and ranges. Undersized conductors can cause inadequate battery charging, low voltage at the optic causing a reduction in intensity and range, and overheating of wires. However, use of "oversized" conductors in these situations provides a simple and effective solution to the problem of voltage drop. Guidelines for proper conductor sizing are available in Standard Drawing 140410 and from Commandant (G-SEC-2).

G. Range Power Systems. After completing the Range Category Selection process described in the Range Category Selection Aid (Figure 1-10), development of the specific range power system at each range light can be completed. Standard range power systems fall into two categories, either commercial 120VAC powered or 12VDC solar powered.

1. Commercial 120VAC-Powered Ranges. These 120VAC power systems are typically some of the simplest in the Coast Guard, consisting of a service drop and a single load circuit breaker. Diagrams of the four standard commercial powered range categories are shown in Chapter 2 (Figures 2-7 through 2-10). Complete engineering interconnection drawings, including wire running lists and bill of materials are listed in Table 7-6, and are available on request from Civil Engineering Units and Commandant (G-SEC-2).

2. Solar 12VDC-Powered Ranges. The four standard solar powered ranges vary in complexity from the simplest self-regulated minor aid, to slightly more complex charge-controlled systems using the Range Power Box, to the rarest system using the Range Light Controller which is more similar to the lighthouse solar power system. Diagrams of the standard 12VDC solar powered range categories are shown in Chapter 2 (Figures 2-11 through 2-15). Complete engineering interconnection drawings, including wire running lists and bill of materials are listed in Table 7-6, and are available on request from Civil Engineering Units and Commandant (G-SEC-2).

Average Maintenance Costs for Alternative Power System (Prepared:)								Aid Name & LLNR:
	Solar Power System		Subcable with E/G Standby		Subcable Only		Prime Power	
	Trips	Cost	Trips	Cost	Trips	Cost	Trips	Cost
1. Regular Service								
2. Discrepancy Visits								
3. Engine Change-Out								
4. Solar Battery Change-Out								
5. Crew Preparation Shoreside								
6. Engine Overhaul								
7. Refueling								
8. Fuel and Lubricants								
9. Utility Costs								
10.Cable Failure Repair								
11.Other Miscellaneous Costs								
TOTAL SYSTEM COST								

ASSUMPTIONS:

FIGURE 3-7
COST ESTIMATING FORM FOR POWER SYSTEM ANNUAL MAINTENANCE

TABLE 7-4

Standard Aids to Navigation Procurement Drawings

Number	Rev	Title
130901	C	Standard Daytank Assembly
130902-1	D	Environmental Control System Prime Power Air Intake Unit Assembly
130902-2	C	Environmental Control System Prime Power Air Exhaust Unit Assembly
130902-3	A	Environmental Control System Prime Power Hoods (Details)
130902-4		Prime Power Environmental Control System, Air Exhaust Hood Assembly
130902-5		Prime Power Environmental Control System, Damper Hood Assembly
130904	A	GCF-RWL-2098, Audio/Visual Controller (21 Shts)
130905		GCF-RWL-2106, AC Flash Controller (7 Sheets)
130909-1		Prime Power Container (10' x 16' x 9'3''), Basic Outfitting
130909-2		Prime Power Container, Monorail Details
130912	A	Signal Control Volume (10' x 16' x 9'3''), Basic Outfitting
130913	B	DC Distribution Panel Assembly 12VDC and 24VDC
130914	A	Emergency Power Entrance Assembly
130915	B	Fire Suppression System Modification
130919	A	Standard High Endurance Engine/Generator Set, 4KW (13 Sheets)
130920	A	Standard High Endurance Engine/Generator Set, 8KW (13 Sheets)
130921	A	Standard High Endurance Engine/Generator Set, 11.2KW (13 Sheets)
130922		GCF-RWL-2423 ATON Power Supply
130923		Range Beacon Controller
130923-XXXX		ACMS (75 Sheets)

TABLE 7-5

Standard Solar Powered Aids to Navigation System Drawings

Number	Rev	Title
Self-Regulated		
140401	C	Category I Solar Powered Lighthouse System
140402	C	Category II Solar Powered Lighthouse System
140403	D	Category III Solar Powered Lighthouse System
Charged-Controlled		
140410	F	Category I Solar Powered Lighthouse System (Regulated)
140411		Solar Category I & II Lighthouse, Fog Detector & Sound Signal Interconnection
140412	A	Category II Solar Powered Lighthouse System (Regulated)
140413		Category III Solar Category Lighthouse System (Regulated)

TABLE 7-6

Standard Aids to Navigation Range System Drawings

Number	Rev	Title
Commercial Powered		
130501		Commercial Night Range (Range Category C-N)
130502		Commercial 24 Hour Range (Range Category C-24)
130503		Commercial Day/Night Range (Range Category C-D/N)
130504		Commercial Range Light Controller (Range Category C-RLC)
130505		Commercial Optional Emergency Range Light
Solar Powered		
140501		Solar Night Range (Range Category S-N)
140502		Solar 24 Hour Range (Range Category S-24)
140503		Solar Day/Night Range (Range Category S-D/N)
140504		Solar Range Light Controller (S-RLC)
140505		Solar Optional Emergency Range Light